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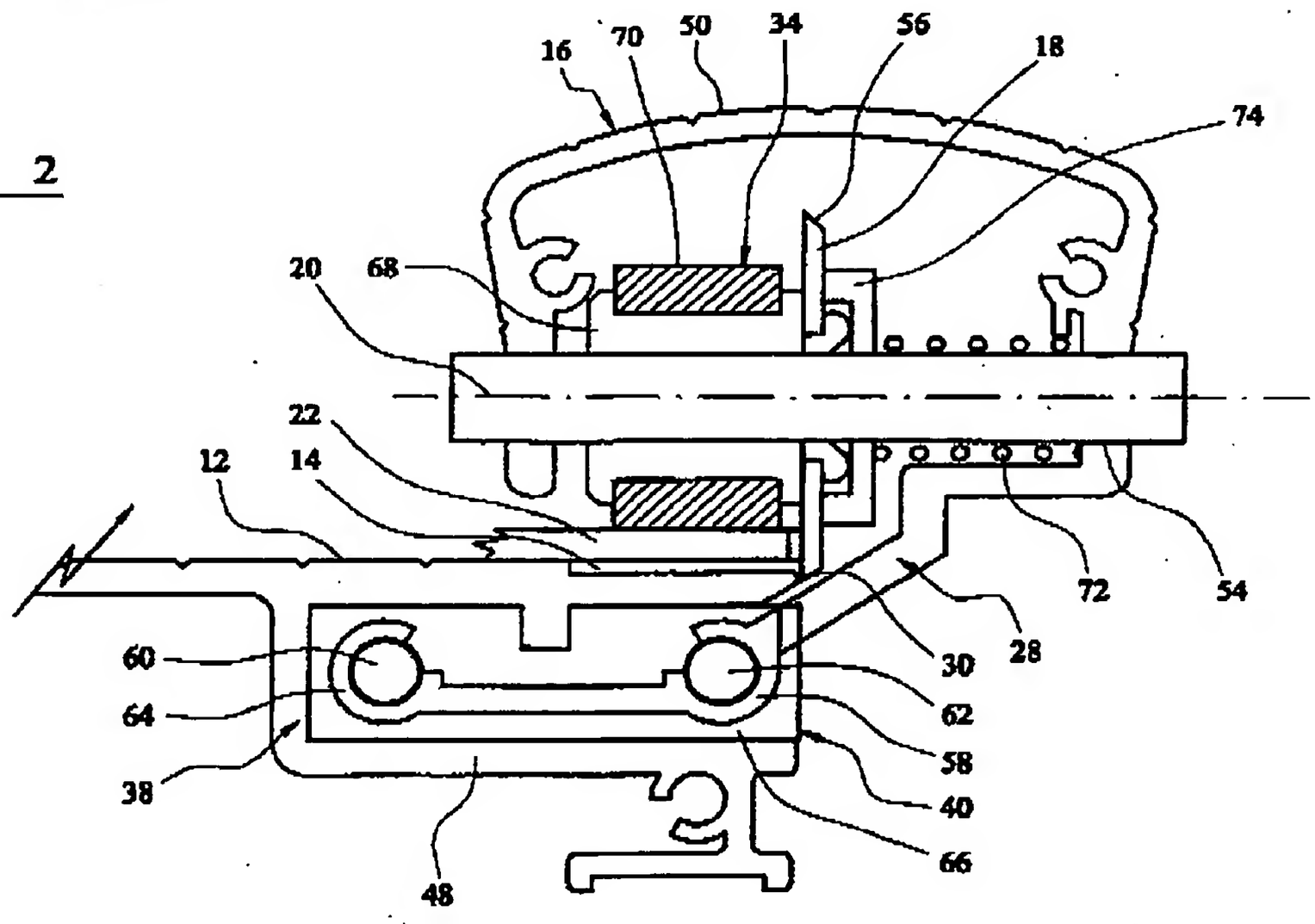
(54) Abstract Title
Cutting sheet material

(57) Method and apparatus for cutting sheet material such as paper and card employs a cutter head having a rotary cutter 18 coacting with a fixed longitudinal blade or edge 14. The cutter head is guided in its cutting action on a guide channel 48 located below the cutting edge whereby insertion of the sheet material to be cut is not limited by the presence of a top-mounted guide rail. A clamp bar 22 is pressed down by roller 70 as the cutter is traversed across.

FIG. 2



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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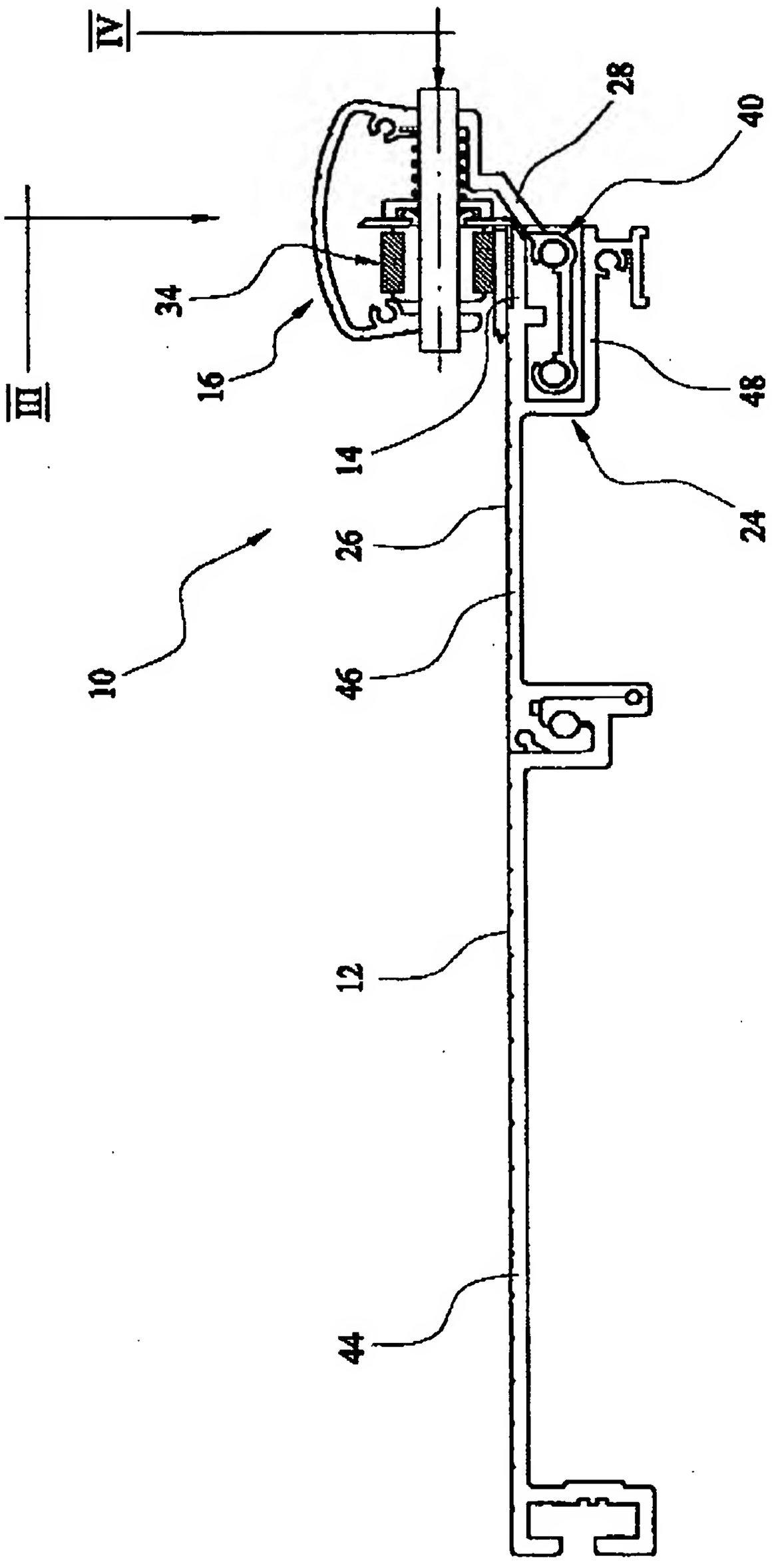

FIG. 1

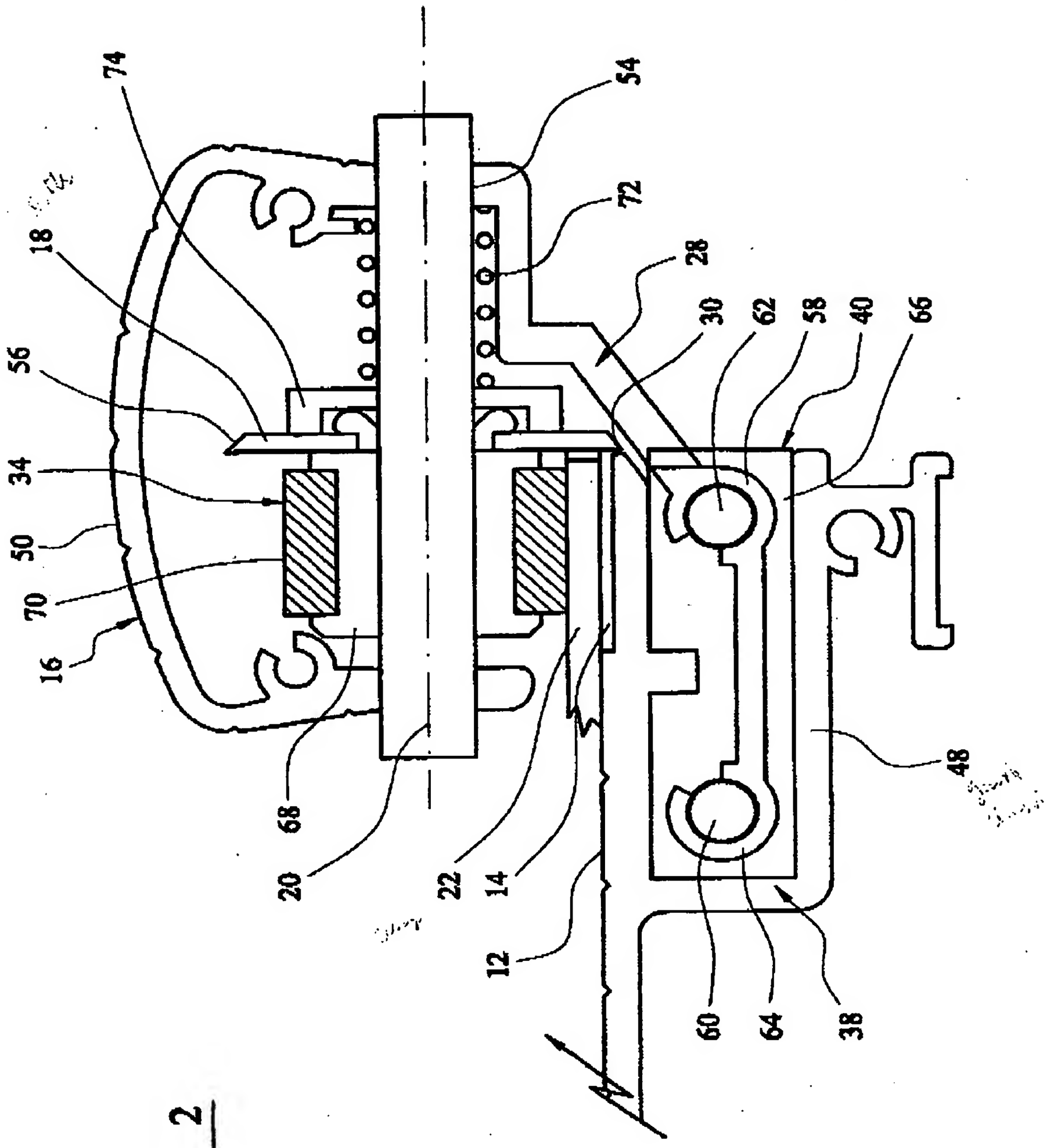

FIG. 2

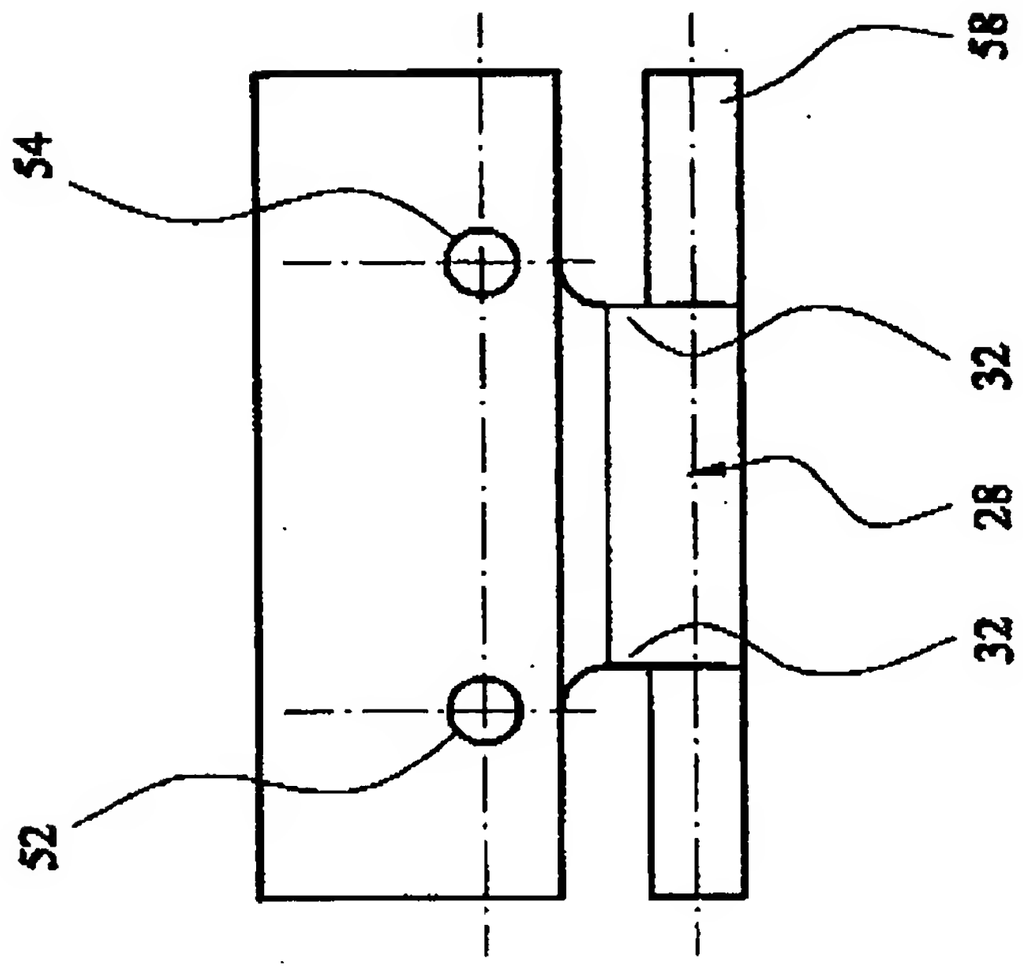

FIG. 4

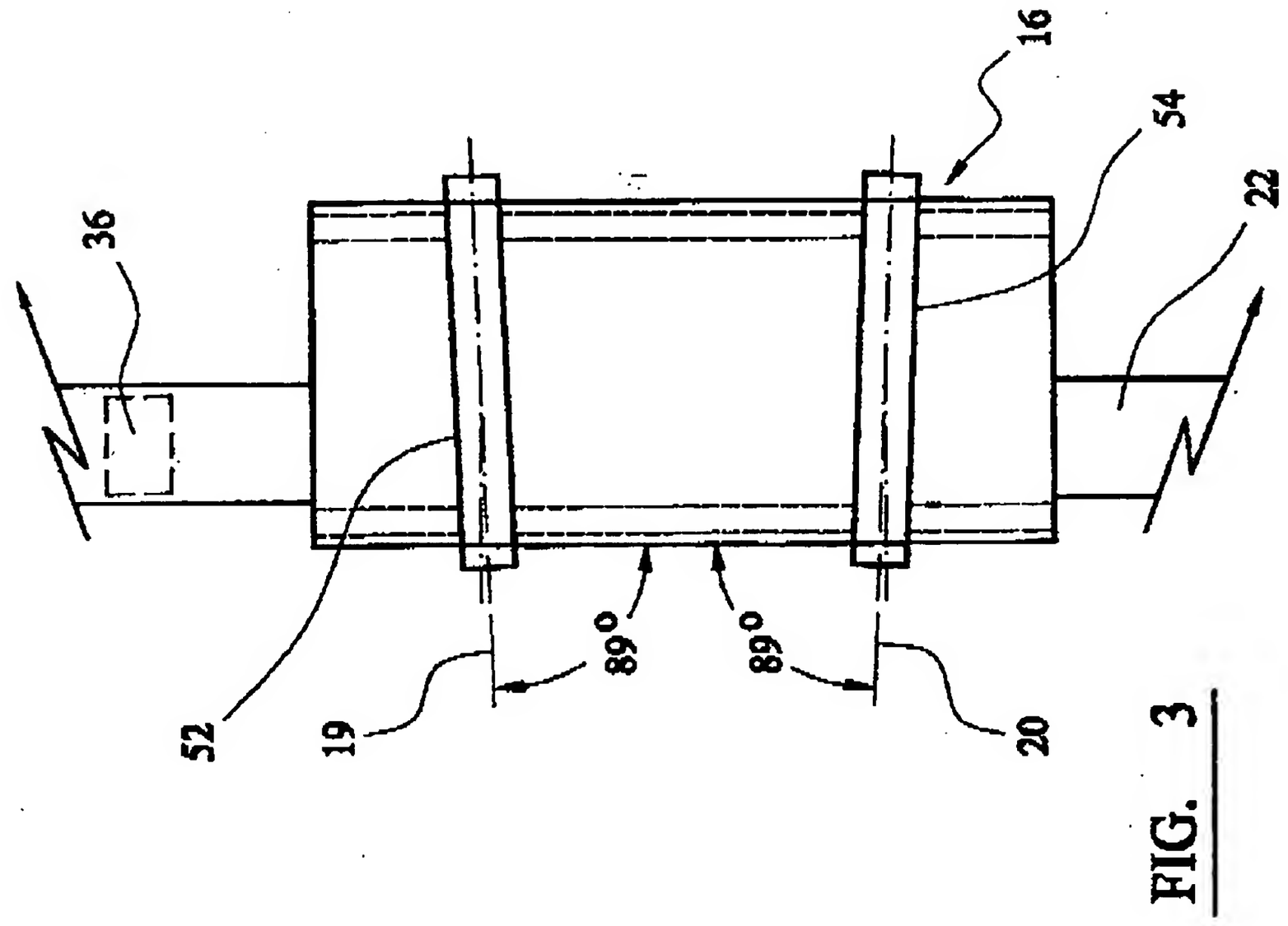

FIG. 3

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METHOD AND APPARATUS FOR ROTARY CUTTING

This invention relates to a method and apparatus for rotary cutting of sheet materials, notably paper and card and board, and certain embodiments of the invention may well also be applicable to the cutting of other sheet materials such as MDF and hardboard and certain light sheet metals etc.

The rotary cutters to which the present invention relates provide a rotary blade mounted on a guided cutter head and cooperating with a longitudinally-extending fixed blade or edge on which the sheet material to be cut is placed.

Such cutters have advantages over guillotine and fixed blade-type guided cutters in that safety aspects of the operation of the cutter are much easier to comply with, and there are resultant advantages in terms of visibility of the cutting operation, not to mention certain advantages in terms of the cut itself, which can arise from the mode driving the rotary cutter itself, whereby, for example, it is driven at a higher rate of rotation than corresponds with the longitudinal or lengthwise travel rate of the cutter head, thereby improving the cutting action.

However, one significant aspect of the technical performance of rotary cutters has remained unimproved for a significant length of time and it is to this area of the design that the present invention is addressed in terms of the first aspect of the invention. This area concerns the mode of supporting and guiding the cutter head.

Conventionally this achieved in existing rotary cutters by means of a mounting bar which extends lengthwise of the cutting region and is located some few centimetres above the cutting edge and provides the mounting and guide and support structure for the cutter head.

In many ways this arrangement is satisfactory in terms of representing the accepted mode of construction of cutters of this kind, in which the heavy structure of a bar conveys a sense of strength and purposefulness to the apparatus as a whole. However, in fact, the guide bar is to some extent anything but a provider of those qualities since (although it may have a relatively substantial structure and cross-sectional shape) it inevitably is supported only in the region of its ends (because the material to be cut has to passed underneath it for action by the cutter) and therefore the guide bar itself imposes limitations on the effective cutting length because (depending on its actual construction and stiffness) it will allow unacceptable deflection beyond a certain cutting length of the cutter as such.

It will be understood that the mounting bar is necessarily at least as long as the cutting length of the apparatus as a whole since it is mounted and supported at its ends in the structure of the baseboard which is usually provided for the apparatus to provide a support for the sheet material to be cut. In some commercial examples of cutters of this kind, the cutter head mounting bar may be 1.5 metres long, or more.

Accordingly, the present invention seeks in its first aspect to provide means whereby a cutter of the kind with which the present invention is concerned can be released from the limitations imposed by the use of such a mounting bar, at least partially, whereby longer cutting lengths can be achieved without the need for a massive mounting bar structure and/or one or more other advantages as disclosed or determinable from the disclosure herein.

It needs to be understood that the technical advance which the present invention seeks to provide in its disclosed embodiments relates to a problem which is fairly specific in terms of its application to a certain class of rotary cutters. Thus, rotary cutters which have hitherto

in the described embodiments of the present invention, the use of a cutter-actuated clamping strip (as opposed to an independently actuated manual clamp as used in twin inrunning rotary cutter element machines) serves further to identify the class of cutting apparatus with which the embodiments of the present invention are principally concern.

According to the invention there is provide a method and apparatus for rotary cutting of sheet materials as defined in the accompanying claims.

In the described embodiments of the invention there is provided an arrangement in which the cutter head of a rotary cutter is not mounted on a longitudinally-extending mounting bar of the kind employed by the prior art, but the cutter head instead is provided with bearing means located generally below (when the apparatus is being used in its conventional horizontal attitude) the cutting edge over which the sheet material to be cut is arranged to extend, and a bridge piece or element extends between the bearing element and the rotary cutter and serves in use to transmit forces therebetween, whereby the bearing element can run lengthwise of a bearing way(which extends lengthwise of the cutting zone) so as to guide and support the cutter head throughout the cutting operation. Such support from the bearing element is provided directly below (and as part of) the cutter head, in the region where it is performing its cutting action. As a result, the cutting action may be performed in an effectively-guided and-supported manner at any location along the length of a cutting edge of any desired length. In other words, the arrangement for guiding and supporting the cutter head no longer is subject to limitations imposed by a mounting bar as described above in relation to the prior art.

The described embodiments of the invention provide bearing means directly below the cutting edge, and structure

supporting the cutter head on this bearing means in a manner which does not require (as the prior art does) the provision of structure extending to the ends of the cutting zone. Instead, the described embodiments of the present invention provide support for the cutter head by structure extending laterally around the cutting zone instead of lengthwise to the ends thereof, and this enables a considerable simplification of the structure, extension of the cutting zone if required, and consequential advantages in terms of manufacturing costs.

According to another aspect of the present invention, a method and apparatus for cutting sheet material comprises providing a cutter head comprising a rotary cutter and mounting same on guide means, and providing the cutter head and the guide means so constructed that the sheet material to be cut is, in use, clamped in a location between the cutter head and the guide means, while being cut.

By this arrangement of the cutter head and the guide means whereby the sheet material to be cut is inserted and clamped between the cutter head and the guide means, simplicity of construction and operation is maximised. Guiding and related forces are transmitted between the guide means and the cutter head through a bridge element which serves to interconnect the two main structural elements of the apparatus while not interfering with the cutting action.

The guide means provides the required degree of attitude control of the cutter head and the necessary clamping forces can thereby be readily applied to the sheet material to be cut, through the cutter head.

In the embodiments, the cutter head comprises drive means for the rotary cutter comprising roller means mounted on a common axis with the rotary cutter element, the roller means comprising a relatively high friction roller element (comprising for example of natural or synthetic rubber) adapted to provide rolling contact with the clamping strip

which serves to clamp the sheet material to be cut onto the baseboard of the apparatus. The rolling diameter of the roller element is chosen to be smaller than the cutting diameter of the rotary cutter element so that a step-up drive arrangement is thereby provided which enhances the efficacy of the cutting action.

Embodiments of the present invention will now be described by way of example with reference to the accompanying drawings in which:

Fig 1 shows a transverse cross-sectional view through apparatus according to the invention and showing cutting apparatus comprising a baseboard to receive sheet material to be cut, guide means provided below and at one edge of the base board and a cutter head connected to the guide means to effect cutting of sheet material placed on the baseboard;

Fig 2 shows on an enlarged scale, the cutter head and guide means of Fig 1;

Fig 3 shows a plan view on a slightly larger scale of the cutter head of Fig 1, the direction of viewing being as shown by arrow roman III in Fig 1; and Fig 4 shows a corresponding elevational view of the cutter head and baseboard of Fig 1, the direction of viewing been as shown by arrow roman IV in Fig 1, and this view omitting other structural details seen in the other drawings.

A method and apparatus for cutting sheet materials such as paper and card and board comprises a support 12 for the sheet material to be cut, a lengthwise-extending fixed blade or edge 14 forming an edge of the support 12 and over which the sheet material to be cut is placed prior to cutting and defining the line of cut, and a cutter head 16 to coact with the fixed blade or edge 14 to cut the sheet material as the cutter head moves lengthwise of the blade or edge.

Cutter head 16 comprises a first rotary cutting element 18 and a second such rotary cutting element 20 to cooperate with the blade or edge 14.

A releasable clamping strip or element 22 is provided to cooperate with the sheet material to be cut, to hold same in place during cutting. The clamping strip is adapted to be actuated by the cutter head to effect the clamping action.

Guide means 24 is provided for cutter head 16 and extending lengthwise of the clamping strip 22 and adapted to guide the cutter head during cutting of the sheet material.

Guide means 24 is located on the opposite side of the blade or edge 14 from the surface of support 12 on which the sheet material to be cut (not shown) rests during cutting.

A bridge element 28 is located laterally outwardly on the cut or outboard side of the edge 30 of the blade or edge 14, away from the releasable clamping strip 22 so that guide forces reach cutter head 16 from guide means 24 without restricting the accessibility of the sheet materials to be cut, to the line of cut defined by blade or edge 14.

As shown in Figs 1 and 2, guide means 24 is located adjacent the lengthwise-extending edge 30 of fixed blade 14 and the transmission of guide forces between cutter head 16 and guide means 24 is effected at a location immediately adjacent the region at which rotary cutting elements 18, 20 effect cutting of the sheet material, and onwards to said support 12 at that location.

Bridge element 28 is adapted to deflect the strip of cut sheet material removed during cutting by having a deflection profile in the form of a chamfered leading edge and a trailing edge in the region thereof which is positioned to intercept the cut sheet material. In use, the deflection profile causes progressive deflection of the strip of cut sheet material as the latter is removed from the remainder of the sheet material.

Cutter head 16 comprises said first and second rotary

cutter elements 18 having respective rotation axes 19, 20 and which are spaced apart in the lengthwise direction of the fixed blade or edge 14 and are adapted to cut the sheet material alternately depending on which side thereof the cutter head starts from. Bridge element 28 is located between the first and second rotary cutter elements 18 20 and thus has twin deflection profiles accordingly.

Clamping strip 22 is, in use, sandwiched between cutter head 16 and guide means 24, and the cutter head 16, by virtue of its attitude as defined by guide means 24 applies clamping forces to the clamping strip in use. Furthermore, cutter head 16 has roller means 34 adapted to engage the clamping strip 22 through roller means 34. Relieved zones 36 (not shown) are provided at chosen locations on clamping strip 22 to relieve the clamping forces exerted on the clamping strip by roller means 34 when required to release the sheet material at the end of a cutting operation.

As shown in Figs 1 and 2, guide means 24 further comprises a longitudinally-extending guide channel 38 having slidably mounted therein a carriage 40 comprising longitudinally spaced slidable guide elements 42 adapted to control the attitude of the cutter head and located generally directly below (when the apparatus is in use in a horizontal attitude) the corresponding lateral width of the cutter head.

Having thus identified the main structural and functional elements of the apparatus 10, we will now describe the relevant associated structures and functions, as follows.

As shown in Fig 1, support 12 is constructed as an assembly of aluminium extrusions, comprising interfitting support or base portions 44, 46 which can be disassembled for storage or transport purposes. Base portion 46 has integrally formed therewith a channel structure 48 to receive carriage 40. Base portions 44, 46 define a generally

flat rectangular support surface 26 on which the sheet material to be cut is placed and ultimately edge-clamped by clamping strip or element 22.

Fixed blade or edge 14 is provided as a hard metal edge portion of aluminium based portion 46 to cooperate with rotary cutter elements 18. The blade or edge 14 is fixed to base portion 46 and extends continuously along the full length of the cutting edge or region of apparatus 10.

Cutter head 16 is in the form of an aluminium extrusion of generally channel-shaped cross-section with a convex upper surface 50 for hand actuation of the cutter head, and having shafts 52, 54 journalled therein and defining axes 19, 20 about which the twin rotary cutting elements 18 rotate. It will be noted that axes 19, 20 are slightly inclined (by about one degree) with respect to the transverse direction with respect to the longitudinal edge of blade 14 or of clamping strip 22.

Rotary cutting elements 18 are journalled for rotation on shafts 52, 54, being formed with bevelled cutting edges 56 for cooperation with edge 30 of blade 14.

Clamping strip 22 comprises a flexible plastic strip or element mounted at the edge of base portion 46 above blade 14 and adapted to have the sheet material to be cut inserted between it and that blade so that it can clamp the material to be cut when cutter head 16 (through roller means 34) exerts a clamping force to fix the material to be cut in its required position. The clamping strip is located in its required position on apparatus 10 by end fasteners (not shown).

Guide means 24 comprises channel structure 48 defined by two side wall and one end wall portions of base portion 46 of support 12, which define an open-sided channel structure into which carriage 40 is inserted so that bridge element 28 can freely reciprocate lengthwise of the open-sided channel.

Carriage 40 forms a further part of guide means 24 and its structure will be further described below. It needs to be understood that the carriage itself serves to provide position and attitude guidance for cutter head 16, thereby ensuring that the latter is precisely positioned in relation to blade 14 and in relation to the sheet material to be cut.

As can be seen in Fig 2, carriage 40 comprises, formed as an integral structure with bridge element 28 as an aluminium casting, a structure comprising a pair of spaced channels 58, 60 receiving respective lengthwise rods 62, 64 and having received thereon, one at each end, a pair of transverse bearing blocks 66, formed of polytetrafluoroethylene (PTFE) which are freely slidable within channel 48 so that carriage 40 moves lengthwise along its line of cut with a relatively low function characteristics.

Bridge element 28 simply serves to connect carriage 40 to cutter head 16 and as shown in Figs 2 and 4 comprises a relatively narrow aluminium flange, profiled at 32 so as to lie between the cutting diameters of the twin rotary cutting elements 18.

Roller means 34 are provided on each of the shafts 52, 54 to drive the twin rotary cutting elements 18 and to exert a clamping effect on clamping strip 22. Each roller means 34 comprises a central hub 68 on which the respective one of the rotary cutting elements is mounted and which has a bearing surface 70 to cooperate with clamping strips 22, and which may comprise an blastomeric material such as natural or synthetic rubber or some other suitable material adapted to cooperate effectively with the clamping strip and to drive the rotary cutting element. It will be noted that the diameter of bearing surface 70 is less than that of the cutting element whereby the latter is rotated faster than corresponds strictly to the linear motion of cutter head 16.

A coiled compression spring 72 located on shaft 54 and

acting through a dished thrust plate 74 biases cutting element 18 against cutting edge 30. A profiled and resilient thrust washer 76 assists to locate and load each of the rotary cutting elements 18 within the dished thrust plate 74 in each case.

In use, apparatus 10 is operated in accordance with the details already outlined in the above description. Sheet material to be cut is inserted between clamping strip 22 and blade 14 with roller means 34 in relieved zones 36. The material to be cut is accurate positioned before moving cutter head 16 so that roller means 34 clamps the sheet material in position. Cutting can then proceed rapidly along the defined line of cut. The sheet material is released by moving roller means 34 into the relevant relieved zones at the other end of the clamping strip.

As the cutter head moves lengthwise of its line of cut, carriage 40 is guided on bearing blocks 66 within channel 48, thereby maintaining a precise line of cut.

Amongst other modifications which could be made within the above embodiment are changes to the structure of carriage 40. Many alternative structures which would provide the required attitude and lateral positioning control could be devised. Likewise, bridge element 28 may vary significantly in design, and of course the cutter head likewise in terms of its overall shape and mode of construction and actuation.

CLAIMS

1 A method for cutting sheet materials such as paper and card and board comprising:

a) providing a support for the sheet material to be cut;

b) providing a lengthwise-extending fixed blade or edge forming an edge of or adjacent said support and over which said sheet material to be cut is placed prior to cutting and defining the line of cut;

c) providing a cutter head to coact with said fixed blade or edge to cut said sheet material as said cutter head moves lengthwise of said blade, said cutter head comprising a rotary cutting element to cooperate with said fixed blade or edge;

d) providing a releasable clamping strip or element to cooperate with said sheet material to hold said sheet material in place during cutting, and said clamping strip or element being adapted to be actuated by said cutter head to effect said clamping action; and

e) providing guide means for said cutter head extending lengthwise of said clamping strip or element and adapted to guide same during cutting of said sheet material; and

f) causing said cutter head to move lengthwise of said fixed blade or edge while said sheet material is supported on said support and is clamped thereon by said clamping strip or element and is cut by said fixed blade or edge and said rotary cutting element;

characterised by

g) said guide means being located on the opposite side of said fixed blade or edge from said surface of said support on which said sheet material rests during cutting, and said method comprising causing said cutter head to be guided on said guide means during cutting by transmitting guide forces between said cutter head and said guide means

through a bridge element located laterally outwardly on the cut or outboard side of said edge of said lengthwise-extending fixed blade or edge and away from said releasable clamping strip or element.

2 A method for cutting sheet materials by means of a rotary cutting element mounted on a cutter head having corresponding guide means, said guide means being located on the opposite side of the apparatus from the surface thereof on which the sheet material to be cut rests during cutting, and a bridge element being provided on the outboard side of the region of cut, and causing same to transmit said guide forces to said cutter head.

3 A method according to claim 1 or claim 2 characterised by said guide means being located adjacent said lengthwise-extending edge of said fixed blade or edge and said method comprising transmitting said guide forces between said cutter head and said guide means at a location immediately adjacent the region at which said rotary cutter head effects cutting of said sheet material.

4 A method according to claim 3 characterised by the step of causing said bridge element to deflect the strip of cut sheet material removed during cutting by providing said bridge element having a deflection profile in the region thereof positioned to intercept said cut sheet material, and the method comprising causing said deflection profile in use to effect progressive deflection of said strip of cut sheet material as the latter is removed from the remainder of the sheet material.

5 A method according to Claim 4 characterised by providing said cutter head comprising first and second rotary cutter elements spaced apart in the lengthwise direction of said

fixed blade or edge and adapted to cut said sheet material alternately depending on which side thereof said cutter head starts from, with said bridge element being located between said first and said second rotary cutter elements and having twin deflection profiles accordingly and the method comprising causing progressive deflection of said strips of cut sheet material by said deflection profiles accordingly.

6 A method according to any one of the preceding claims characterised by providing said clamping strip sandwiched or clamped, in use, between said cutter head and said guide means, and said method comprising causing said cutter head by virtue of the attitude of same defined by said guide means to apply clamping forces to said clamping strip.

7 A method according to Claim 6 characterised by the step of providing said cutter head with roller means to engage said clamping strip and said method comprising causing said cutter head by virtue of the attitude of same defined by said guide means, to apply clamping forces to said clamping strip through said roller means.

8 A method according to any one of the preceding claims characterised by said guide means comprising a guide channel adapted to control the attitude of said cutter head, and said channel being positioned so as at least partially to be located directly below (when the apparatus is in a horizontal attitude) the corresponding lateral width of said cutter head.

9 A method of cutting sheet material comprising providing a cutter head comprising a rotary cutter and mounting same on guide means;

characterised by

the step of providing said cutter head and said guide

means so constructed that the sheet material to be cut is in use clamped between the cutter head and guide means while being cut.

10 A method according to any one of the preceding claims characterised by the step of providing said clamping strip comprising relieved zones at chosen locations to relieve the clamping forces exerted on the clamping strip by a roller element adapted to roll on said clamping strip or element while driving said cutter element, and the method comprising causing said roller element to effect such relief at such locations at the end of a cutting operation.

11 Apparatus for cutting sheet materials such as paper and card and board comprising:

a) a support for the sheet material to be cut;

b) a lengthwise-extending fixed blade or edge forming an edge of or adjacent said support and over which said sheet material to be cut is placed prior to cutting and defining the line of cut;

c) a cutter head to coact with said fixed blade or edge to cut said sheet material as said cutter head moves lengthwise of said blade, said cutter head comprising a rotary cutting element to cooperate with said fixed blade or edge;

d) a releasable clamping strip or element to cooperate with said sheet material to hold said sheet material in place during cutting, and said clamping strip or element being adapted to be actuated by said cutter head to effect said clamping action; and

e) guide means for said cutter head extending lengthwise of said clamping strip or element and adapted to guide same during cutting of said sheet material; and

f) said cutter head being adapted to move lengthwise of said fixed blade or edge while said sheet material is

supported on said support and is clamped thereon by said clamping strip or element and is cut by said fixed blade or edge and said rotary cutting element;

characterised by

h) said guide means being located on the opposite side of said fixed blade or edge from said surface of said support on which said sheet material rests during cutting, and said cutter head being guided on said guide means during cutting by the transmission guide forces between said cutter head and said guide means through a bridge element located laterally outwardly on the cut or outboard side of said edge of said lengthwise-extending fixed blade or edge away from said releasable clamping strip or element.

12 Apparatus for cutting sheet materials by means of a rotary cutting element mounted on a cutter head having corresponding guide means, said guide means being located on the opposite side of the apparatus from the surface thereof on which the sheet material to be cut rests during cutting, and a bridge element being provided on the outboard side of the region of cut which transmits said guide forces to said cutter head.

13 Apparatus according to claim 11 or claim 12 characterised by said guide means being located adjacent said lengthwise-extending edge of said fixed blade or edge and said apparatus being adapted to transmit said guide forces between said cutter head and said guide means at a location immediately adjacent the region at which said rotary cutter head effects cutting of said sheet material.

14 Apparatus according to claim 13 characterised by said bridge element being adapted to to deflect the strip of cut sheet material removed during cutting by providing said bridge element having a deflection profile in the region

thereof positioned to intercept said cut sheet material, and said deflection profile being adapted in use to effect progressive deflection of said strip of cut sheet material as the latter is removed from the remainder of the sheet material.

15 Apparatus according to Claim 14 characterised by said cutter head comprising first and second rotary cutter elements spaced apart in the lengthwise direction of said fixed blade or edge and adapted to cut said sheet material alternately depending on which side thereof said cutter head starts from, with said bridge element located between said first and said second rotary cutter elements and having twin deflection profiles accordingly and the apparatus being adapted to cause progressive deflection of said strips of cut sheet material by said deflection profiles accordingly.

16 Apparatus according to any one of claims 11 to 15 characterised by said clamping strip being sandwiched or clamped, in use, between said cutter head and said guide means, and said cutter head by virtue of the attitude of same defined by said guide means being adapted to apply clamping forces to said clamping strip.

17 Apparatus according to Claim 16 characterised by said cutter head roller means being adapted to engage said clamping strip and said apparatus being adapted to cause said cutter head by virtue of the attitude of same defined by said guide means, to apply clamping forces to said clamping strip through said roller means.

18 Apparatus according to any one of claims 11 to 17 characterised by said guide means comprising a carriage slidable in a channel to control the attitude of said cutter head, and said channel being positioned so as at least

partially to be located directly below (when the apparatus is in a horizontal attitude) the corresponding lateral width of said cutter head.

19 Apparatus for cutting sheet material comprising a cutter head comprising a rotary cutter mounted on guide means;

characterised by

said cutter head and said guide means being so constructed that the sheet material to be cut is in use clamped between the cutter head and said guide means while being cut.

20 Apparatus according to any one of the claims 11 to 19 characterised by said clamping strip comprising relieved zones at chosen locations to relieve the clamping forces exerted on the clamping strip by a roller element adapted to roll on said clamping strip or element while driving said cutter element, and said roller element being arranged to effect such relief at such locations at the end of a cutting operation.

Application No: GB 0017208.0 **Examiner:** A.R.Martin
Claims searched: **Date of search:** 23 November 2001

Patents Act 1977
Further Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B4B

Int Cl (Ed.7): B26D1/00

Other: On line databases WPI,EPODOC,JAPIO

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	GB2289430 A	NEC see page 9 last paragraph to page 10 first paragraph	Claims 9 and 19 at least
X	JP2000-176881 A	Hayashi Shingo see abstract	"

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
		E	Patent document published on or after, but with priority date earlier than, the filing date of this application.
&	Member of the same patent family		

Application No: GB 0017208.0
Claims searched: 1-8,10,20

Examiner: Dave Butters
Date of search: 20 February 2001

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.S): B4B

Int Cl (Ed.7): B26D

Other: Online: WPI, EPODOC, PAJ

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,Y	GB 2289430 A	(NEC) whole document	X-1-4,8,11-14,18 Y-6,7,10,17,20
Y	GB 2141371 A	(ROTATRIM) page 2 lines 31-71	6,7,10,17,20
Y	EP 0084347 A	(LEPTONS) page 5 line 19 - page 6 line 3	6,7,10,17,20

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.